

PPI Hedonic Model for Broadband Internet

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Overview

- Background
- Capturing quality change
- Model development
- Changes to model
- Current model
- Ongoing research



Background

INTERNET SERVICE
PROVIDER



■ Pricing methodology

- ▶ Average revenue per subscriber for a specific plan
- ▶ Actual transaction price for a specific plan

Figure 1: Index values of 5173116 Internet access services since December 2016



Capturing quality change

■ Item Substitution

- ▶ Technological change
- ▶ Increasing download and upload speeds

■ Need for Hedonic Quality Adjustment

- ▶ VQA - Dollar value of change in download or upload speed
- ▶ Ability of respondent to provide information



Original Model



Introduced in December
2016



Ordinary Least Squares
regression



Used BLS PPI broadband
data for the sample

Original Model Variables

■ Service Characteristic Variables

- ▶ Selected company (dummy)
- ▶ Residential or business service (dummy)
- ▶ 2 interaction variables

■ Independent Variable

- ▶ Log(download speed)

■ Dependent Variable

- ▶ Log(price)

$$\log(\text{price}) = A + \beta_1(\log(\text{download speed})) + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon$$

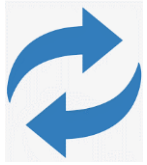
Original Model Estimates

$$\text{VQA} = \left(\left(\frac{\text{New download speed}}{\text{Old download speed}} \right)^{\beta_1} - 1 \right) \times \text{Old price}$$

Historical VQA coefficients, 2016-2021, old model

| Year | log Download coefficient | Standard error |
|------|--------------------------|----------------|
| 2016 | 0.3075 | 0.0977 |
| 2017 | 0.28416 | 0.04604 |
| 2018 | 0.24208 | 0.05236 |
| 2019 | 0.21824 | 0.04206 |
| 2020 | 0.23684 | 0.03577 |
| 2021 | 0.33565 | 0.06179 |

Changes to Model - 2022



Need for Change

- ▶ Introduced new PPI sample
- ▶ Preference for average price
- ▶ Average prices unusable in model



Solution

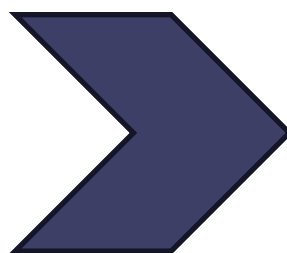
- ▶ Third-party data provider
- ▶ Telecom list prices for residential internet service
- ▶ Thousands of data points available

Changes to Model - 2023

Subgroup analysis based on transmission type

CABLE

FIBER OPTIC

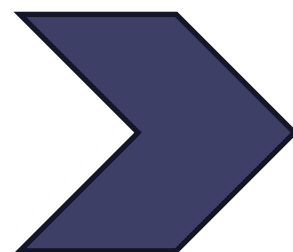


- Speed affects price
- Remain in database
- Items adjusted by new model
- 70% of US market share

DSL

Satellite

Wireless



- Speed does not affect price
- Removed from database
- Not adjusted by new model
- Rarely adjusted since 2016

Current Model

Historical VQA coefficients, 2016-2023

| Year | log(Download speed) coefficient | Standard error |
|-------------------|---------------------------------|----------------|
| 2016 | 0.3075 | 0.0977 |
| 2017 | 0.28416 | 0.04604 |
| 2018 | 0.24208 | 0.05236 |
| 2019 | 0.21824 | 0.04206 |
| 2020 | 0.23684 | 0.03577 |
| 2021 | 0.33565 | 0.06179 |
| 2022 ^a | 0.143567 | 0.003294 |
| 2023 ^b | 0.337264 | 0.005252 |

^a Used third-party database

^b Used third-party database and excluded DSL, satellite, and wireless

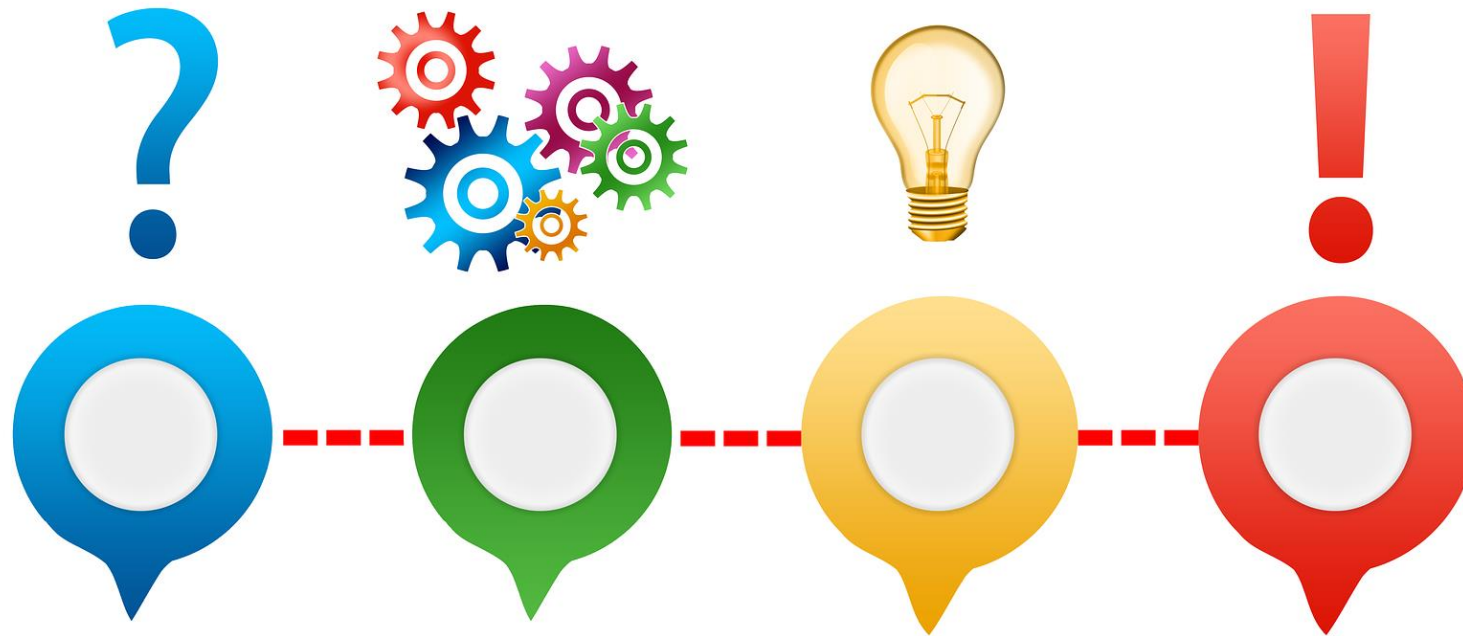


Ongoing Research



- **Time-Dummy Model**
- **More frequent Updates**

Questions or Comments?



Contact Information

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